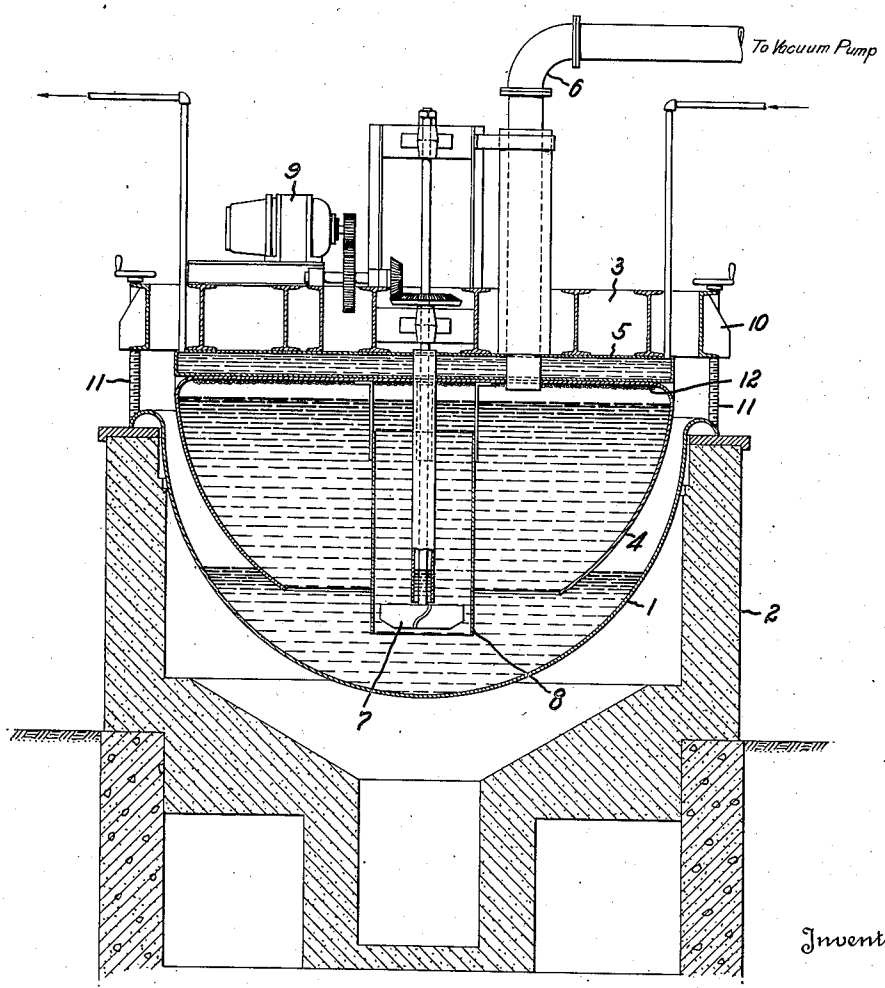
Feb. 8, 1949. W. T. ISBELL 2,461,280

REFINING OF LEAD

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2,461,280

REFINING OF LEAD

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1 Claim. (Cl. 75—78)

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The present invention relates to the removal of zinc from lead, particularly from lead which has been desilverized by treatment with zinc.

In the refining of lead, it is common practice to remove silver from the lead by the addition of zinc which forms with the silver a zinc-silver compound substantially insoluble in lead saturated with zinc at temperatures of the order of 900° F. However, after removal of the zinc-silver crusts the lead contains from 0.5 to 0.6% of zinc which must be removed for most of the commercial uses of lead.

Until recently it has been the usual practice to remove the remaining zinc from the lead by heating the lead to red heat in an oxidizing atmosphere, whereby the major portion of the zinc together with a substantial portion of lead were oxidized to form a slag or dross which was skimmed off and resmelted to recover the lead content.

It was proposed at an early date to remove the zinc by distillation but this method was found to require a relatively high temperature and a large proportion of the lead volatilized with the zinc at the temperature of distillation.

More recently it has been proposed to remove zinc from lead by treating the molten lead with oxidizing agents such as chlorine or nitrates, or with caustic soda, or with mixtures of caustic soda and nitrates. All of these methods require the use of expensive chemical reagents and the zinc is converted into salts or oxide of reduced value.

I have now found that the disadvantages of the previously proposed methods may be avoided and the zinc content of the lead removed and recovered in the form of metallic zinc with substantially no loss of lead and without the use of either high temperatures or chemical reagents, by subjecting molten lead containing zinc to low pressures. It has been found that at absolute pressures not exceeding about 10 mm. and preferably from 1 mm. to 0.5 mm. of mercury and at temperatures of from 900° F. to 1200° F., preferably at about 1080° F to 1125° F., the zinc content of the lead volatilizes readily with a relatively small proportion of lead and may be condensed and recovered in metallic form.

I have found it to be particularly desirable to condense the zinc vapors upon a cooled surface positioned relatively close to the free surface of the molten lead under vacuum and to provide means, such as a suitable agitator, for continually circulating the molten lead to the surface exposed to the vacuum. An advantageous apparatus for practicing the new lead refining

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process comprises a container for the lead to be refined, means for heating the container, a bell member open at the lower end, preferably at least about forty inches in depth, and adapted to be immersed in a charge of molten lead in the container, means for evacuating the interior of the bell member and means for cooling the upper surface of the bell member. A suitable form of apparatus is shown by way of example in the accompanying drawing.

In the drawing, 1 is a kettle of, for example, 120 tons capacity mounted in a furnace setting 2. 3 is a removable vaporizer-condenser comprising a bell 4, in the shape of a truncated inverted hemisphere. The flat top surface of the bell is provided with a water-cooled jacket 5 and a vacuum line 6, leading to a vacuum pump, opens into the interior of the bell just below the top surface. A stirring propeller 7 mounted in agitator well 8 is driven by motor 9.

The vaporizer-condenser assembly is carried on a framework 10 adapted to be mounted on studs 11 carried by the furnace setting 2.

The following is a typical example of the operation of the process of the invention.

A charge of about 110 tons of lead containing about 0.5% of zinc is placed in kettle 1 with the vaporizer-condenser removed, and heated to 1100° F. The lead is skimmed free of dross, and the vaporizer-condenser is put in position as shown in the drawing, and water connections to the cooling jacket are made. The temperature of the lead normally drops about 50° F. when the vaporizer-condenser assembly is submerged in the charge. When the temperature has been brought back to 1090° F., the stirrer and the vacuum pump are put in operation. The temperature is preferably maintained at about 1090° to 1100° F. and the pressure at about 0.5 mm. of mercury during the dezincing treatment which for a batch of this size requires about seven hours.

After the completion of the vaporization, the stirrer and vacuum pump are stopped, the water and vacuum connections are broken and the vaporizer-condenser is removed from the kettle.

The zinc condenses in a coherent crystalline mass on the underside of the water-cooled top surface of the bell, as indicated at 12, and is readily removed by vibrating the surface. Residual portions of the deposited zinc are removed by scraping.

In general, about 90% of the zinc content of the lead is recovered and the lead after treatment contains 0.05% or less of zinc. The recov-

ered metallic zinc is useful in the desilverizing of further portions of lead.

Any cadmium which may be present in the lead, for example, from the ore or from the zinc used in the desilverizing process, will be eliminated from the lead by the treatment of the invention. It is therefore possible, when using the treatment of the invention, to use zinc having a substantial cadmium content in the desilverizing of lead.

Although the apparatus shown and described for the purpose of illustrating the principles of the invention has been found to be particularly useful, the process of the invention is not limited to any particular form of apparatus but may be practiced in any apparatus capable of subjecting the lead to a vacuum of the order of 10 mm. of mercury or less at a temperature of from 900° F. to 1200° F.

The apparatus of the invention is claimed in my U. S. Patent No. 2,422,967.

A method of removing zinc from lead containing a small amount of zinc of the order of that left in lead by the zinc desilverizing process which comprises maintaining a body of molten zinciferous lead at a temperature of about 1100° F., agitating said body of lead to provide a continually renewed extended surface thereof, subjecting the extended surface to a reduced absolute pressure of not more than about 1 millimeter of mercury, and maintaining an extended water-cooled solid surface adjacent said extended surface of molten lead.

WILLIAM T. ISBELL.

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Certificate of Correction

Patent No. 2,461,280 February 8, 1949.

WILLIAM T. ISBELL

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 3, line 22, before the paragraph beginning with the words "A method of removing" insert *I claim:*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of June, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.